SOUND AND VISION

The Game-shaped Archive

A playful, flexible approach to the preservation of computer games

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Abstract
Over the past decades computer games have become an established part of a rapidly transforming media landscape. As such they cannot be ignored by cultural heritage institutions. The ephemeral and interactive qualities of games do require a varied and flexible approach to their preservation. Various methods of preservation must be combined in order to do justice to the various aspects of games as cultural heritage. A playful attitude towards the preservation of computer games will help archives to navigate this complex and at times daunting task.

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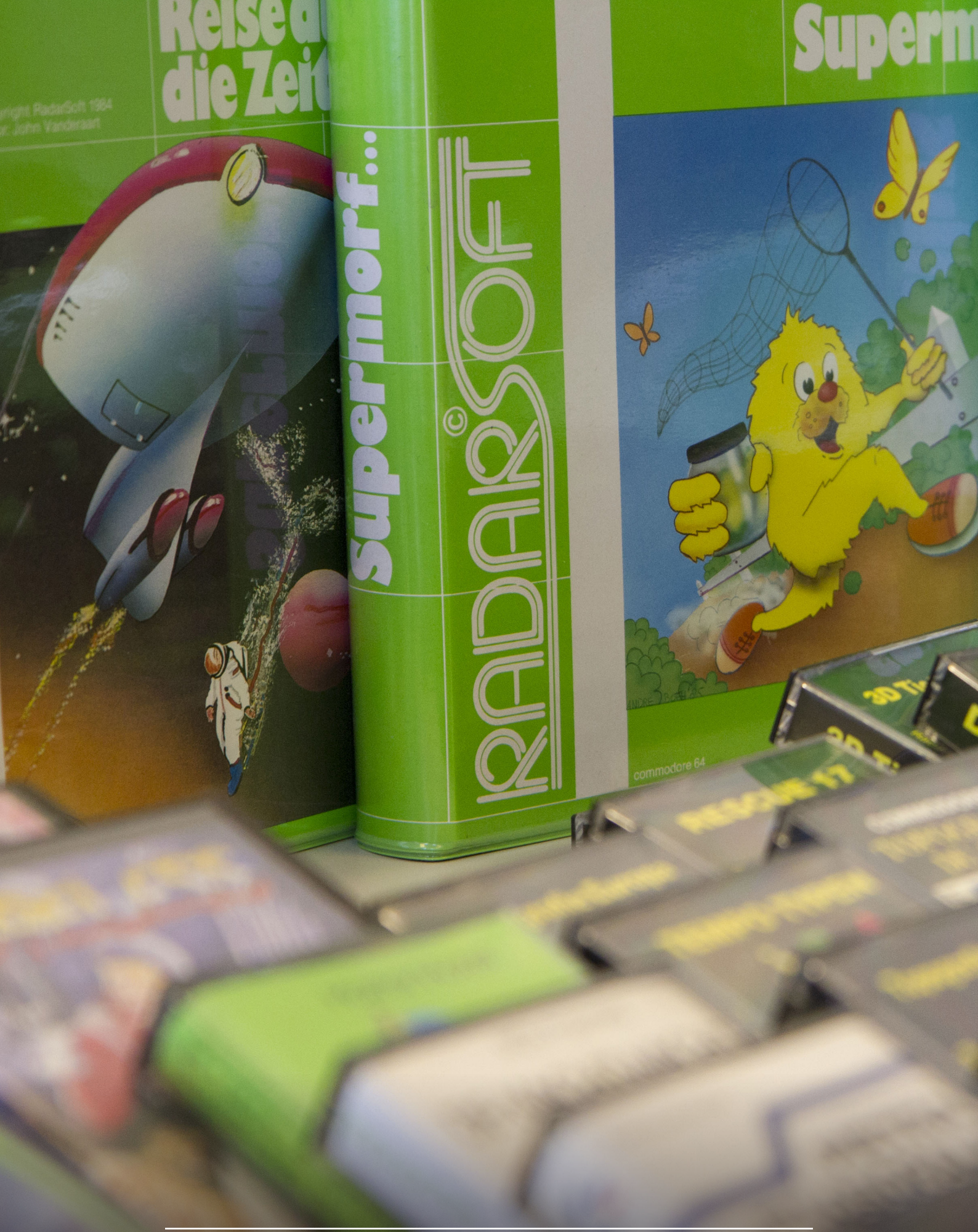


The first acquisition of Dutch games at Sound and Vision: various games from Radarsoft, a pioneering game company from the 80s.

Introduction

In 1935, several decades after the introduction of film as a new medium, MoMA was one of the first established cultural institutions to take up film as part of its archival collection (Slide 1992). It marked the beginning of a greater appreciation for film as a legitimate art-form and as cultural heritage worth saving. In 2012 MoMA acquired fourteen iconic computer games in its Architecture and Design collection (Antonelli 2012). The fact that such a well-established museum would consider games worthy of preservation still indicates an important moment in time. The urgency for preservation is clear: games because of their digital, interactive and transient nature are arguably even more fragile as archival objects than film is.

In 2016 and 2017 The Netherlands Institute for Sound and Vision (short: Sound and Vision) ran a pilot project in collaboration with Utrecht University to archive and preserve Dutch computer games from the 1980s and 1990s. The project, titled Game On! was successful in acquiring more than 50 games, establishing new workflows and employing new techniques to preserve these games. This article will reflect on some of the lessons learned during the project but will first look at games as a part of our audiovisual cultural heritage: what are the arguments to preserve games in the first place? And why do games as cultural objects require specific attention? Then it will look at the state of the art of various methods of game preservation and the choices Sound and Vision made in the process during the Game On! project. Finally it will discuss some requirements for archives to become successful at preserving games for future generations.

1 The project website (in Dutch) can be found here: https://www.beeldengeluid.nl/kennis/projecten/game-on

The appraisal of games as cultural heritage

The notion of 'cultural heritage' is defined by UNESCO as "the legacy of physical artefacts and intangible attributes of a group or society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations." The examples UNESCO gives on its website still reveal a focus on more ancient historical objects such as coins, manuscripts, monuments, shipwrecks, etc. But this broad tentative definition can (and as will be argued: should) of course include much more recent cultural artefacts. This is also something UNESCO is aware of, writing in 2003 already that "digital heritage is at risk of being lost and [...] its preservation for the benefit of present and future generations is an urgent issue of worldwide concern.' (UNESCO: Charter on the Preservation of Digital Heritage, 2003)

In recent years we have seen various examples of established heritage institutions, with various collections and selection criteria, that consider games part of our cultural heritage and worth preserving and presenting. There are various angles along which games can be considered worth saving: as mentioned, MoMA took up a small selection of games in its 'applied design' section, with a strong focus on the aesthetics of the game. The Strong National Museum of Play added games to its existing collection of toys and boardgames. And the Australian Centre for the Moving Image collects Australasian games as a proponent of physical and social memory. So for a public, national, audiovisual archive like Sound and Vision, what does it mean to think about games as cultural phenomena?

A GAME-SHAPED SOCIETY

Computer games have become an inseparable part of the world-wide audio-visual culture as shown by statistics. Revenues are sky-high, approaching one hundred billion USD yearly (against the movie industry with 38 billion in box office revenues in 2015 (McClintock 2016). People spend more and more time playing games. On average Dutch people play computer games for almost 20 minutes per day. Within the age group 13-19 daily time spent on games is as high as 45 minutes (Wennekers et al 2016). Though most popular among younger generations, gamers can be found in all age categories and they play games ranging from mobile games to advanced MMO's (Massive Multiplayer Online games). Gaming in recent years has also quickly become professionalised, with e-sport events drawing audiences in stadiums and millions of views for gaming videos and streams on platforms like YouTube and Twitch. In short: games form a significant part of the way in which people spend their time, energy and finances.

Games are sometimes considered in isolation, as pure entertainment. Even before the introduction of computer games however, games were already studied as an essential and central element of civilization. As Huizinga put it in his seminal book Homo Ludens in 1938: "culture arises in the form of play, (...) it is played from the very beginning." (Huizinga 46). Computer games specifically are a powerful illustration of this broad scope of the phenomenon of play. Through computational technology games have permeated many areas in our societies. From the earliest stages of the development of computer games (especially in the Netherlands) people have been intrigued with their educational potential. Early topography game series Topografie (Radarsoft 1984) was distributed in various European countries and even featured in a Dutch educational TV

show called 'It's All in the Game'. So called applied or serious games have seen many adaptations in for instance healthcare and the military. The popularised concept of 'gamification', the application of game elements in a non-game context, illustrates that computer games have become an intrinsic part of the way in which people think about the transference of knowledge and skills. Games also feature in many political and societal debates. The infamous Gamergate controversy in 2014 for example exposed the harassment that especially women face in online gaming communities. Another example is the ongoing debate on the relationship between in-game violence and real-life violence that originated in the nineties with the publication of games like Doom (1993) and Grand Theft Auto (1997). Games can even make some contribution to societal debates. Two Dutch examples: Hollanditis (Radarsoft 1985) is a quirky text adventure game that critically reflects on America's nuclear weapons stationed in the Netherlands. Or a decade later: A2 Racer (Davilex 1995) in which players can let off steam racing down the A2 highway, notorious for heavy traffic and speed limitations. Finally, especially for younger generations, (online) games are a social medium of sorts. They experiment with roles and identities in what Frissen et. al. call "ludic identity construction" (Frissen et al, 2015 p. 11). Players form relationships in the game that may or may not have an expression in the 'real' world (ibid. p. 37).

THE NATURE OF GAMES AS ARCHIVAL OBJECTS

As we have seen, various institutions will consider games in various ways, based on their missions and already existing collections. Over the past decades the Netherlands Institute for Sound and Vision has developed its collection mostly existing out of public radio and television broadcasting materials, essentially defined by one-way communication.There are significant ways in which games are distinct from linear media productions as archival and cultural objects. For many people, playing arcade and console games in the 1970s and 1980s, these were the first introduction to digital, interactive media. Games continue to display the many affordances of digital technology as a socio-technological constellation. Understanding the nature of games is a prerequisite for evaluating where our current approaches of (digital) preservation need to be re-evaluated.

First of all, games have all kinds of relational qualities: they are networked, participatory, immersive and interactive. As Turkle already put it in the mid 1980s: "Video games are a window onto a new kind of intimacy with machines that is characteristic of nascent computer culture" (1984 p. 60). To preserve these more relational aspects of games it is helpful to use conceptual frameworks to understand and describe these aspects. One possible framework is called cybernetics. It finds its historic roots in WWII, when Norbert Wiener developed an automatic

range finder for anti-aircraft guns. Soon after that it became a standard to describe computational processes, but also automated control processes in living things. According to Ashby, who wrote an influential work on cybernetics in 1956, it answers the question: "what does it do?" (1957 p.1) rather than just "what does it mean?". It considers machines in relation to their respective environments. It is therefore particularly apt for the analysis of games. The feedback loop, in which input and output follow upon each other in quick succession, is a defining feature of computer games. Game designers spent a lot of creative energy and time on fine-tuning the game mechanics that constitute this feedback loop of input and output. What Pierre Lévy writes about new media artists is also true for game developers: "the artist now attempts to construct an environment, a system of communication and production, a collective event that implies its recipients, transforms interpreters into actors, enables interpretation to enter the loop with collective action (...)" (in Hansen 2007 p.144). The dynamic feedback loop described above, by definition makes for obscured boundaries between the production, the producer and consumer. In our preservation we therefore need to consider the entire network or environment of actors, both human and technological.

Second, this gaming environment is shaped in a very specific moment in time and in a specific material manifestation which we call gameplay. The way in which a game is being played at any point in time is influenced by the historical backdrop, the demographics of the player, his or her skill, the intention with which he or she plays and so on. Where film or television might be 'perceived' differently by each viewer, games are actually changed in their material manifestation. For some games this is particularly urgent, such as World of Warcraft (WoW) and other MMO's. The primary way in which WoW functions is through social interactions. Say we would be successful in preserving the game itself (the virtual world in which the interactions take place), it would still tell us very little about the nature of the gameplay that would have taken place there at a certain point in time. How do we capture and archive something of the 'situatedness' of gameplay? Which forms of documentation can register the ways in which players played a particular game at a certain point in time?

The material manifestation of the game environment plays an important role in the way the game is experienced as good or bad, the degree to which it can invoke feelings of excitement, stress, nostalgia, aggression, etc. Where museums attempt to offer an experience alongside the transference of knowledge, the original hardware becomes an almost invaluable asset. For researchers also, especially in the field of media-archaeology (the likes of Huhtamo, Ernst and Parikka) matter matters. They are concerned with the study of the material manifestation of media in order to offer an "epistemologically alternative approach to the supremacy of historical narratives" (Ernst, 2011:239). In short facilitating access to the material aspect of games, in some way, shape or form, should be a concern in game preservation.

State of the art: methods of game preservation

By studying the literature and the current practice at other institutions we have defined five methods or strategies for the preservation of computer games. These methods are ordered along the lines of their potential for preserving the original, authentic game and experience. The first method is the preservation of hardware, which pertains to the storing of devices and original carriers, either as passive objects or with the goal of keeping them playable. For users of the archive the original hardware ensures a close approximation of the experience of the game the way it was at the time of publication.

The second method is Migration, by which we mean the activity by which an older digital file-format is transformed or transcoded into a newer file-format. This can be done automated or by a human agent who reprograms the whole production into new code. When performed by a human agent specific attention can be paid to details that approach the 'look-and-feel' of the original.

The third approach to preserving games is emulation: the preservation of the original game as a diskimage and either the original software as a virtual environment or an emulator that mimics the original hard- and software environment. The adaptation to current hardware comes at a loss of authenticity.

Fourthly, reinterpretation is a method by which one tries to re-conceptualise a certain game to a more up-to-date and appealing form, while remaining truthful to the original significant properties of the game. It is more concerned with the game's concept than with its historical original.

Finally, documentation is concerned with storing secondary sources (registrations, descriptions, contextual information, etc) that depict, contextualise or explain the game in question. This can be done for a variety of goals and from various perspectives. Each of these method comes with its own limitations and benefits. These are summarised in the table on the next page.

	HARDWARE PRESERVATION	MIGRATION	EMULATION / VIRTUALIZATION	REINTERPRETATION	DOCUMENTATION
Sustainability	**Low** It can vary depending on many factors (climate, use, quality, availability of spare parts, technical expertise, etc.). For the long term it's very challenging due to the sheer quantity of hardware platforms and the ephemerality.	**Average** In theory migration presents us with a sustainable method for preservation of computer games. However, the continuous investments of time and resources are such that it generally is not considered a feasible method for complex media objects.	**Good** Emulation aspires to being platform independent. It can in principle be employed into the future. Downside: emulators are often developed by communities of players and development is sometimes abandoned. Also emulators for new platforms are usually only developed several years after the introduction of said platform.	**Low** The reinterpreted version of the game is a new product that also needs to be preserved. It therefore forms a temporary solution.	**Excellent** Documentation normally exists out of formats such as text, images and video. For each of these, standards exist and rigorous migration workflows can be implemented that have proven to be very trustworthy over time.
Scalability	**Low** There are hundreds of gaming platforms and consoles. Preserving these would require a lot of space, spare parts and specific knowledge.	**Low** Games would have to be migrated on a case-by-case base since there is so very little standardization.	**Average** Emulation software doesn't have to be developed by a single party. By using the work of mentioned communities and collaborating with other institutions emulation can be facilitated for a wide selection of games and platforms.	**Low** Conceptually, one has to determine on a case-by-case basis which significant properties the original game has and how these translate into the reinterpreted version.	**Good** Depending on the exact documentation method chosen, it can be done in fairly standardized and therefore scalable ways. In some cases it could even be crowdsourced.
Accessibility (independent of legal issues)	**Low** Only on-site, only a limited number of people at the same time.	**Good** (Online) distribution for re-use is a possibility and easy due to adaptation of production to the latest and commonly used appliances and software.	**Good** Emulation can be facilitated online and can potentially be made very straightforward for end-users (see EaaS and online arcade by Internet Archive described elsewhere).	**Good** Assuming that the reinterpretation is created for present-day platforms it should be easy to distribute to end-users that can then play the game on their own devices.	**Excellent** Distribution of documentation can be done online through any number of distribution platforms. Because they are standardized formats end-users do not need additional applications.
Cost of implementation	**Average - High** Depending on the platform, devices and parts can become quite rare, raising the price significantly.	**Very high** The customized approach that is needed makes migration a very expensive undertaking for games. Prize can be as high as developing a new game.	**Average** In a scenario where emulation is applied to a large number of games created for the same platform the price per game drops significantly.	**Very high** Again, a customized approach that requires a new game to be created from scratch whilst conceptually considering the original game.	**Low** Again, depending on the exact method of documentation chosen, but doesn't have to be costly.
Preserves	- Original look and feel - Interactive functionality - Materiality of games	- Interactive functionality - (Can mimic look and feel)	- Interactive functionality - (Can mimic look and feel)	- Potentially the original impact of a game - An interactive rendition of the original game	- Original look - Context (reception, use, production)
Does not preserve	- Context	- Materiality of game	- Materiality of game	- Materiality of game	- Materiality of game - Interactive functionality
Knowledge required	- technical knowledge of large variety of devices and carriers, and skills to repair when needed.	- Advanced programming skills	- Knowledge of emulation/ virtualization - Knowledge of converting various carriers to diskimages	- Having a sense of the significant properties of a game	- Knowlegde about the games and their context

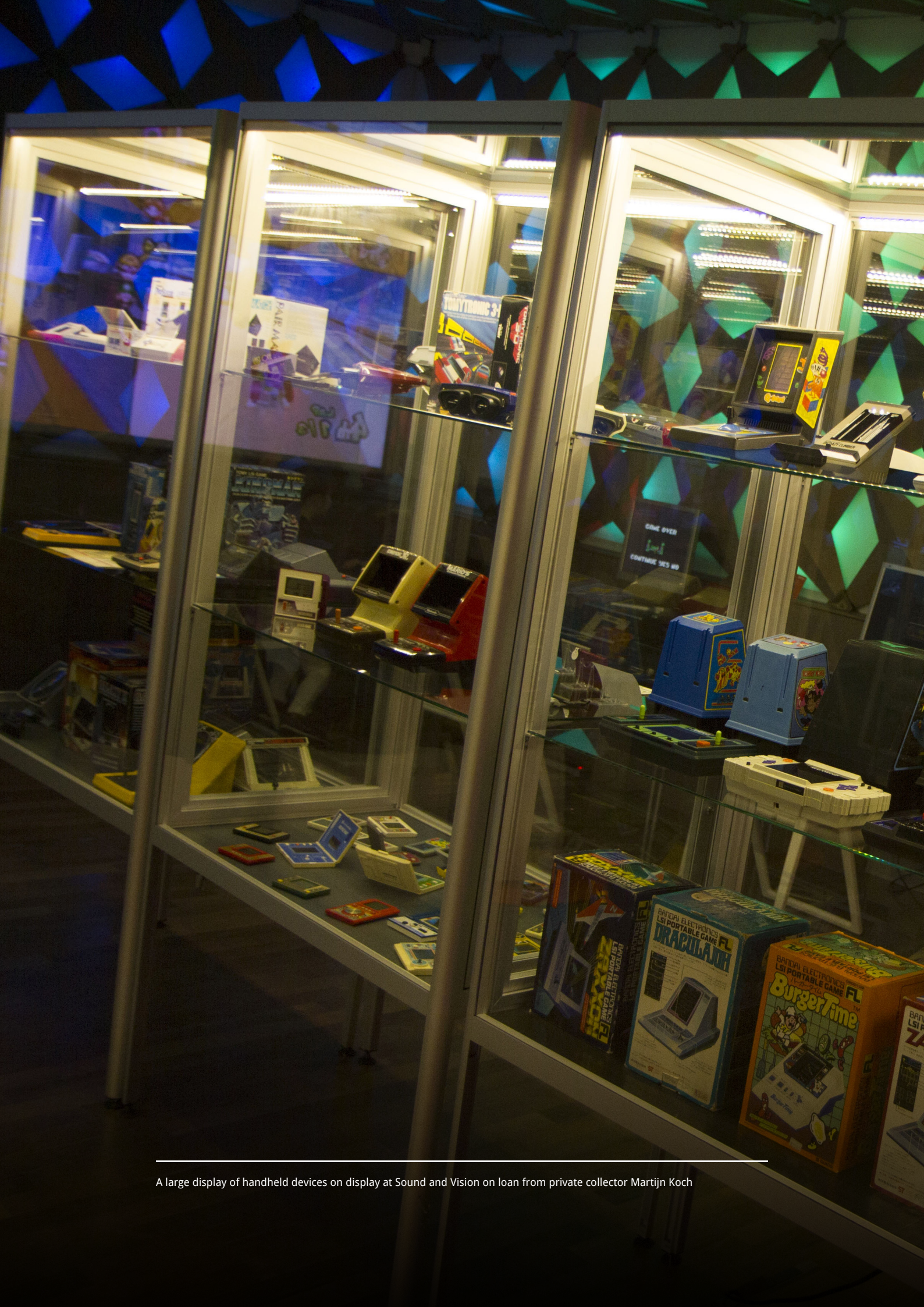
Table 1: An overview of limitations and benefits for the various methods of preservation for games.

Gamepreservation at Sound and Vision

In this section the choices Sound and Vision made in relation to the different preservation strategies will be described. Sound and Vision is a public institution and the national institute for media culture. Its holdings comprise over a million hours of (often digitized) material, which we make available to a variety of end-users, including journalists, students, researchers, heritage organisations and the general public. The institute is also a museum, that aims to interpret current media developments from a historical perspective. As a trustworthy digital archive we make every effort to be compliant with the standards that have been established internationally. Of these the OAIS-model (Open Archival Information System) is the most important (de Jong, 2016). This tried and tested reference model for digital archives offers a framework within which the processes for ingestion, storage, access, migration and delivery are described. OAIS also informs and structures our work with games.

HARDWARE PRESERVATION

For now at least, Sound and Vision has decided against hardware preservation (beyond physical carriers) for its games collection. The main arguments for this decision were the fact that there are other organizations in the Netherlands that are better positioned for the preservation of hardware, the limited sustainability of this approach and the limited possibilities for providing access to the material. Instead of starting a new collection of hardware from scratch, Sound and Vision tries to build relationships with a network of (amateur) collectors and use these relationships to facilitate access to hardware for research and exhibition purposes. During the Game On! project a temporary exhibition of games was formed using collections of several collectors. Initiatives like Awesome Retro and *Het Nederlands Instituut voor Games en Computers* hold large collections of hardware and have the knowledge to maintain these collections for as long as is possible. These and other initiatives are often driven by a sense of nostalgia and fandom, with a lot of attention to the original 'look and feel'. Because of the voluntary nature of their work, each collection displays the preferences of its owner, which can be either a particular game, a specific platform or time-period. The knowledge of maintenance of these collections is informally distributed through forums, YouTube video's and on physical locations. The communities are diverse in nature, some with a more experimental approach in which hardware can be modified, new games produced for retro consoles, etc. Others focus on keeping the hardware as original as possible. There is a general awareness though that preserving and repairing hardware like this is a finite strategy. At some point spare parts will run out, external circumstances change, and original carriers will be subject to bitrot.



A large display of handheld devices on display at Sound and Vision on loan from private collector Martijn Koch

MIGRATION

Thus far migration has been the default method of preservation for Sound and Vision's linear audiovisual archival objects such as video and audio. Automated migration or conversion is performed by a piece of software that can both 'read' the original file-format and translate it into the newer file-type. For complex objects like games, automated migration is not an option since they are built up of large numbers of file types. Migration therefore requires a human agent that re-programs the whole production for more recent systems. The newly coded version can then be kept as a 'new vernacular rendition' (Rothenberg 2000) next to the 'original' file or it can replace the original file altogether. Re-programming an entire game manually is, in most cases incredibly labour intensive, especially in the absence of the source code. Also, it would only solve the issue for a limited amount of time, until the system on which the new version runs becomes obsolete. In short Sound and Vision has adopted the idea that migration does not provide a scalable solution for the long-term preservation of complex media objects (see also: Rosenthal 2015).

EMULATION AND VIRTUALIZATION

Sound and Vision will adopt emulation as the dominant strategy for the long-term preservation of games. It offers a sustainable way of providing access to the human-technological feedback loop that constitutes the game. Emulation is a procedure by which a certain computer system (the host), mimics the qualities (both software and hardware) of another system which enables it to execute software applications stored as disk images that were intended for the other system. Over the past years the ideas of long-term preservation of software and digital works has shifted to emulation as the most promising strategy. The advantage is that the emulated game can be played on current systems, making it independent of fragile and/or obsolete hardware. It also becomes easier to provide access to a game, since an emulator uses disk-images which are digital and therefore can be copied to various digital carrier types without restrictions or loss of quality.

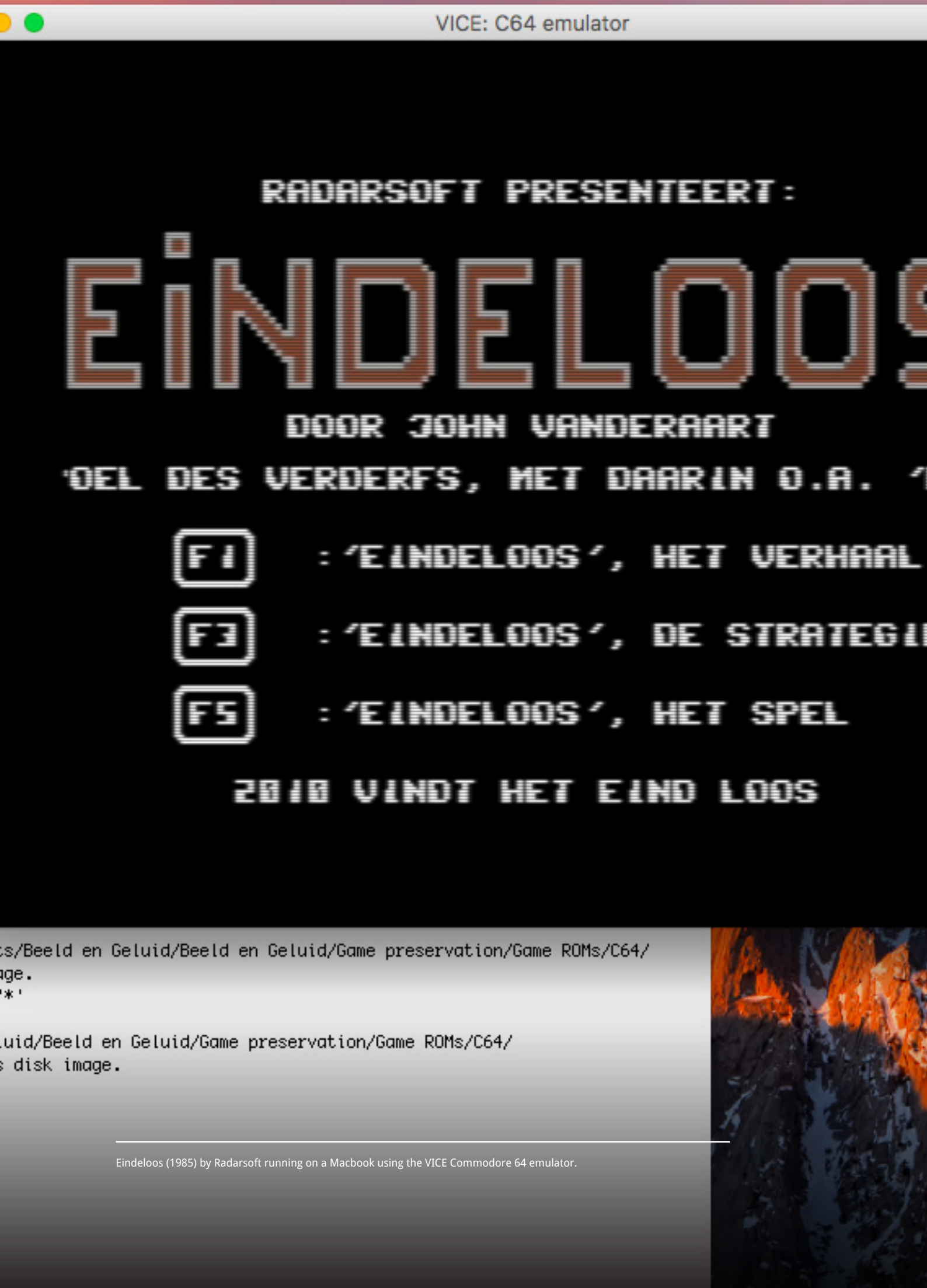
The exact procedures by which emulation takes place are described in detail by, for instance, Rosenthal (2015) and Rechert et al (2016). Rosenthal suggests that for many digital object, migration is a better, cheaper option. However, for complex objects such as games, emulation is a necessity. Emulation for preservation was indeed pioneered by computer game enthusiasts, making the application of emulation relatively(!) simple, since the tools (emulators) and disk images - or ROMs - are often already there. There are considerable issues with this as well though, as described in the for game preservation still authoritative report "Preserving Virtual Worlds" (2010). When a community of fans and collectors drives emulation efforts, these efforts often remain unfinished, are abandoned from further development and lack detailed documentation, and focus on popular retro consoles, not on more recent (and therefore more complex) consoles and systems. Also, because of the informal nature of these communities, the legal status of such emulators is often contested.

Rosenthal concludes by discerning two major barriers for the application of emulation as a preservation strategy: first the tools for creating preserved system images are inadequate, which makes obtaining images labour intensive; and second that the legal basis for using emulation is unclear.

Rechert et al (2016) look specifically at emulation of software based artworks, an even more complex task considering the lack of standardization requiring a case-by-case approach. They suggest that emulation entails the acquisition and maintenance of software environments, not just the artwork itself. Applied to game preservation this expands collection policies significantly and one must realise that such a task needs to be performed in close collaboration with other institutions that are concerned with the preservation of software to be able to handle the scale at which such efforts would need to take place.

Emulation potentially could enable online accessibility, something Sound and Vision will look at more closely. Over the past few years the Internet Archive has worked on a repository of computer games. To make these accessible online they worked on a JavaScript version of two of the most popular game emulation software packages (MAME for arcades and MESS for consoles). The result is called JSMESS and with it, Internet Archive makes available 4000+ DOS games, 900+ Arcadegames and 500+ Atari games simply in one's browser. Though far from perfect (games have glitches, sound doesn't work, controls are odd, etc.), this effort of the Internet Archive has shown that emulation can be achieved at scale for a non-expert audience. Another way of making games available online through emulation was explored by bwFLA (University of Freiburg) and Olive (Carnegie Mellon University), called Emulation as a Service (EaaS). EaaS is a distributed emulation framework that hosts the emulation process in the cloud, on servers offsite. The end-user doesn't need any detailed knowledge of the emulator or configurations, but can simply load and play a piece of software in their browser.

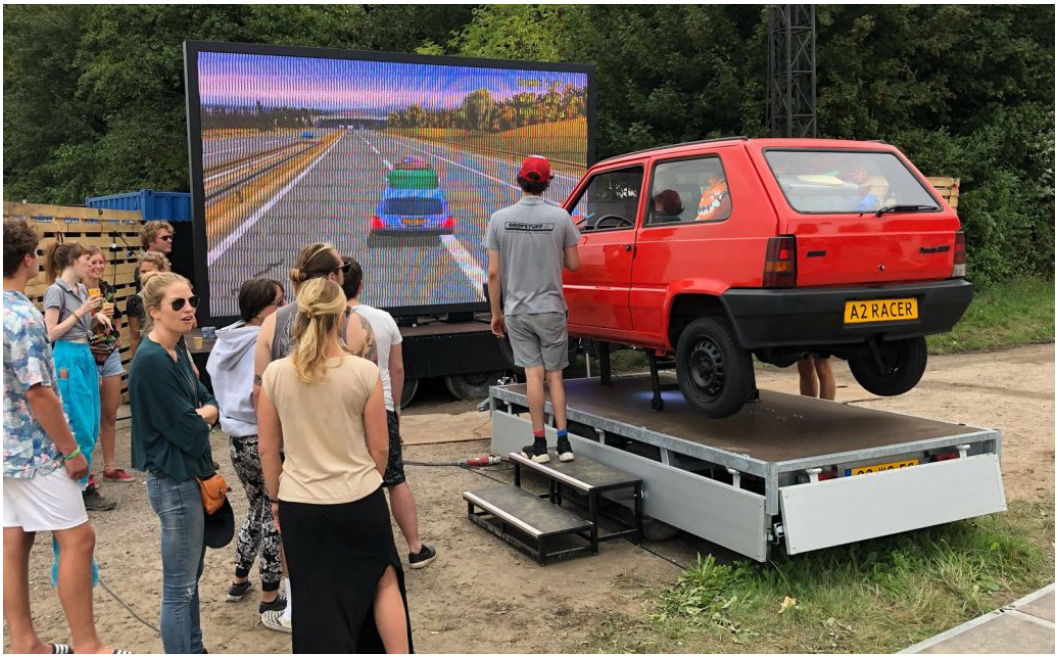
Sound and Vision has developed workflows for the creation of disk images for various carriers (Commodore 64 tapes, MSX tapes, PC CD-roms). These disk images have been tested in a particular emulation environment. We are now in the process of re-evaluating our current preservation metadata (based on PREMIS) to pay specific attention to the dependencies that games have on their technological environment.



Eindeloos (1985) by Radarsoft running on a Macbook using the VICE Commodore 64 emulator.

REINTERPRETATION

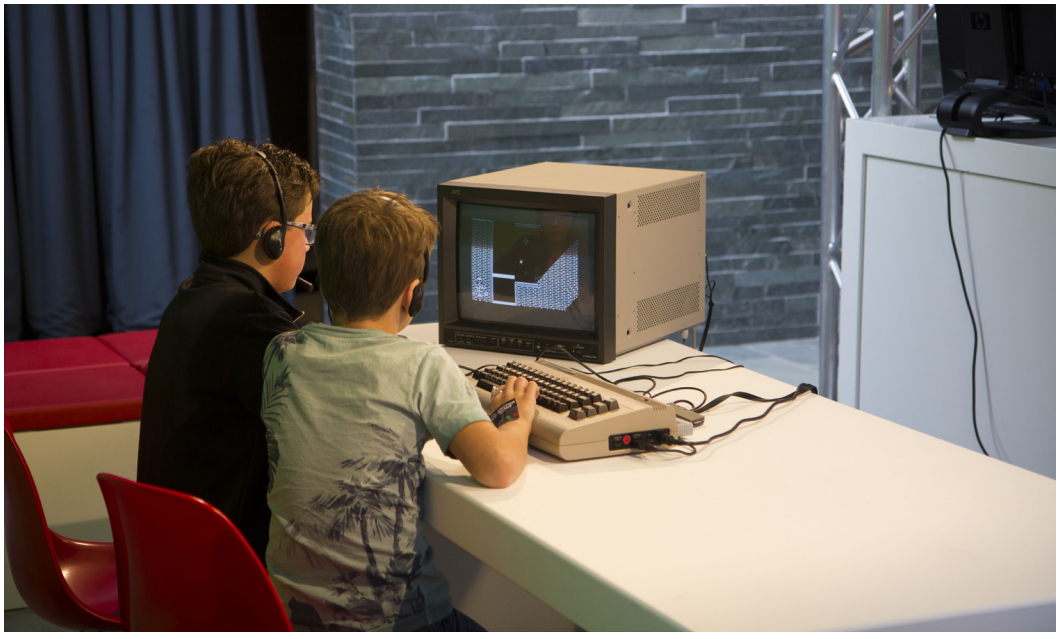
The methods listed above can be seen as object-oriented methods of preservation. We now move towards methods that have a more secondary relationship to the game as an object. Reinterpretation is mostly a strategy maintained by museums and institutions preserving art installations. Due to for instance obsolete technology or the limitations of a physical space, a museum and (where possible) the artist work together to reinterpret a work in such a way that the original message or the original effect is conveyed. After the Game On! project we collaborated with Dropstuff to create a fairground attraction in which we used a game from our archive, Vakantieracer (Holiday Racer) (2000) developed by Davilex, to engage with a new and wide audience. The installment titled 'Time Travellers' combined the original game with Augmented Reality, archival footage and mechanics to create what we called an 'escape room on wheels', that connected to the nostalgic feelings many Dutch people hold in relation to going on holiday to Southern Europe. For Sound and Vision reinterpretation can potentially play a role in the future presentation of games in its museum. Essentially what this means is that in archiving a game, specific attention must be paid to documenting significant properties and possibly the producers' intended effect with the game.



A prototype of Tijdreizigers (Time Travellers) being tested at the Lowlands music festival.

DOCUMENTATION

The final method is documentation which aims to capture and preserve information about the context in which the game was produced and received. To interpret the games as cultural objects understanding this broader context is essential. Documentation offers a way to capture an archival object in another medium than in which it was originally published. Documentation can take the shape of textual descriptions, photographs, schematic drawings, audio and video recordings, etc. Documentation can also add layers of meaning, where it captures conduct of users and producers or gives a sense of the historical context in which a game was played. Simultaneously however, documentation can outlive the game itself and become an object in and of itself. If documentation is the sole focus of preservation, we eliminate the physical and interactive experience of playing a game. As a secondary, complementary method Sound and Vision will continue to explore opportunities for documentation. During the Game On! project we recorded and archived a few play-through video's with maker's commentary which offered valuable insights into the conditions under which they worked and the degree to which the games were innovative at the time of their release. We also recorder over 50 so called Let's Play video's with museum visitors. In Let's Play video's, a popular phenomenon on platforms like YouTube and Twitch, players record their own gameplay whilst commenting on it in voice-over. Recording these videos didn't only offer a great way of encouraging visitors to give more time and attention to these older games but also to consciously reflect on them. In preserving these video's we captured gameplay as a historically situated event, the way in which people respond to them. They also "highlighted interesting original qualities of older games such as their lack of tutorials, their limited action opportunities, and the materiality of hardware and software carriers" (see Glas et al 2017).



Two young museum visitors recording a Let's Play video.

The game-shaped archive

In what is written above we have considered games as cultural heritage, their inherent properties and the methods of preservation that are available. We will now look at how these should shape the way in which archives are organised to successfully engage with games. As we have seen above, games are inherently multifaceted media, encompassing and obliterating boundaries between technology and people, makers and players, gameplay and storytelling, genres, etc. Therefore archives need to be flexible in technology and playful in attitude.

First, flexible in technology: all the tools and systems used need to be adaptable to new file formats and alternative forms of ingest and access. They need to consider and combine multiple approaches (especially documentation and emulation) if they want to do justice to computer games as archival objects. After the initial ingest of a game into the archive the work isn't done yet. Periodical checks are necessary to see whether the digital files are still recognisable and whether the disk images work with the latest emulation environments. The metadata schema that is being used to describe archived games must be flexible enough to support a wide variety of formats, and to change overtime where developments in the game-sector require it. The standard vocabulary used to describe platforms and genres must be supported and maintained by a wide community in order to keep up with a fast moving industry.

Second, in the complex field of games a more playful attitude is required (see also: De Vos 2013). This applies for instance to selection criteria and acquisition procedures. Things that don't easily fit pre-determined categories can still be relevant to a collection if one wants to be able to retell the story of burgeoning technologies for instance. The new media archivist is therefore also an opportunist. Active acquisition is required and sensitivity towards this fragmented media landscape is of the essence to curate meaningfully. Even with a well developed sensitivity for the developments in the game industry, it is unlikely that archives independently can keep up with the fast evolution of new media and more specifically trends in game development. The game-shaped archive therefore also acts as a node in a network and knows how to engage knowledgeable groups of (amateur) experts in the process of selection and acquisition. Archivists become facilitators of this process of what is sometimes called crowd-curation (e.g. Blaser 2016). They also interact with scholars and historians in order to grasp the narratives that constitute the history of the medium of games in society.

The questions we are faced with in dealing with game preservation far exceed the level of the individual institution. Possible alleys for collaboration are varied. For example combining forces in establishing selection policy and aligning collections to avoid blind spots. Or the realisation of an infrastructure similar to Emulation as a Service (previously described) in order to make games accessible. Also, work on shared thesauri that cover gaming platforms, genres, Operating Systems, emulations software and the like would be most fruitful in close collaboration. Facilitating and maintaining that network is an intrinsic part of the work of a game-shaped archive.

FUTURE WORK AND CONCLUSIONS

By taking the first steps in game preservation it has become clear for Sound and Vision that there are a lot of questions that still need to be answered. With regards to sustainable digital preservation of disk images questions around the use of preservation metadata need to be answered. When talking about games, what exactly is the archival object, or Archival Information Package in OAIS terminology? How do we describe the dependencies on the technological environment(s) in which the game functions? Which events are relevant to the provenance of games as archival objects?

In Game On! we focussed on Dutch games from the 80s en 90s. Todays' games are much more complex, from online functionality of MMO's to automatic updates and in-app purchases of games from the app store. More work needs to be done to develop practices around the preservation of such games. It might mean that we move away almost completely from object-oriented preservation and shift our focus towards documentation.

As previously described, providing online access to games through emulation is a possibility, but it hasn't seen any sustainable application at a larger scale (apart from the Internet Archive). Building a (possibly shared) infrastructure that offers emulation as a service to the end-user could be a literal game-changer.

Despite these big open ended questions, archival institutions that deal with computer games can't afford to sit back and watch history evolve. The archive's primary task as guardians of cultural heritage can invoke a certain conservatism which can be at odds with the dynamic described above. The remedy? Simply start doing things, playfully.

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